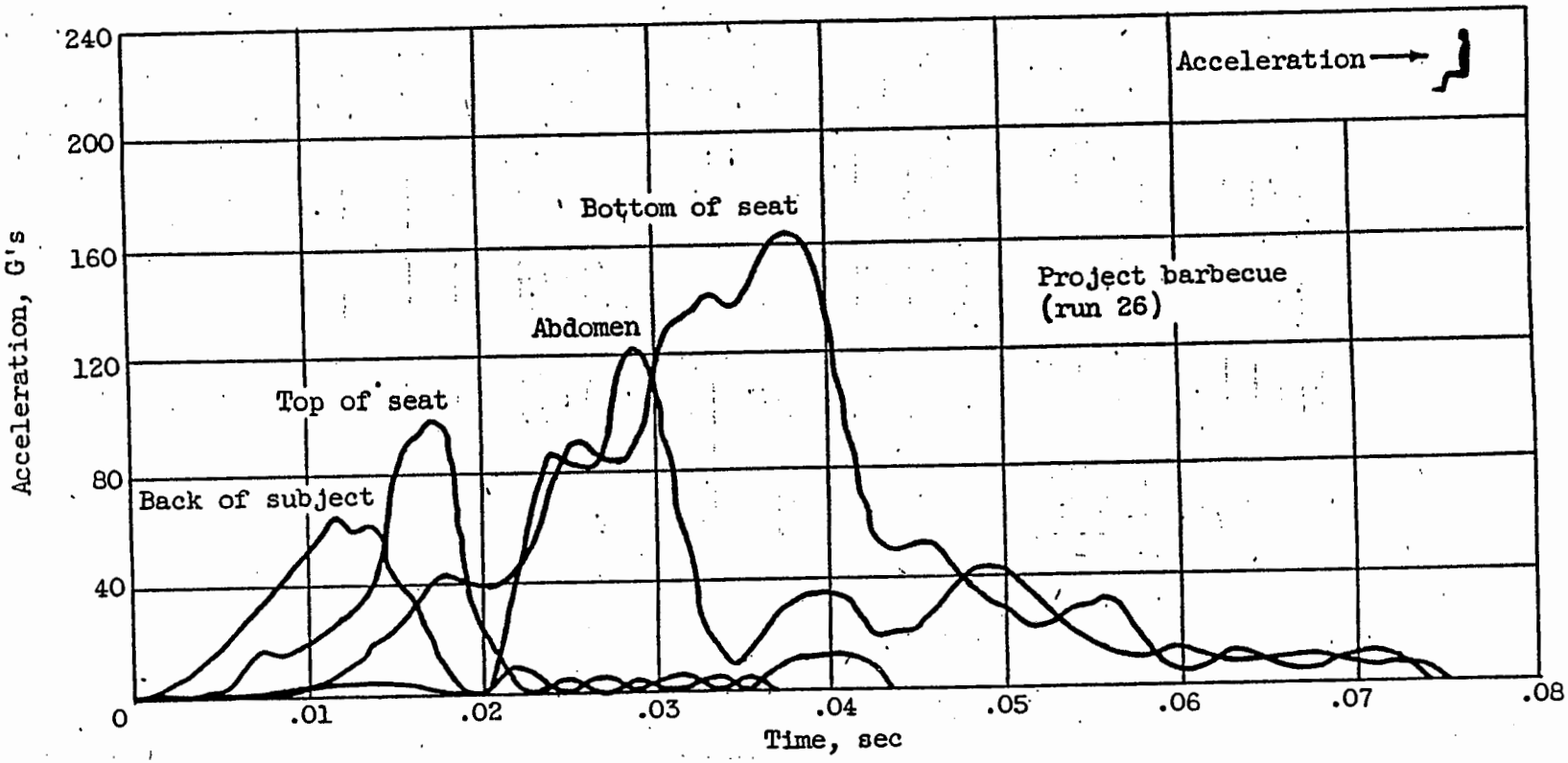

Figure 6. - Spineward acceleration record from experiments with hog subjects (ref. 9).

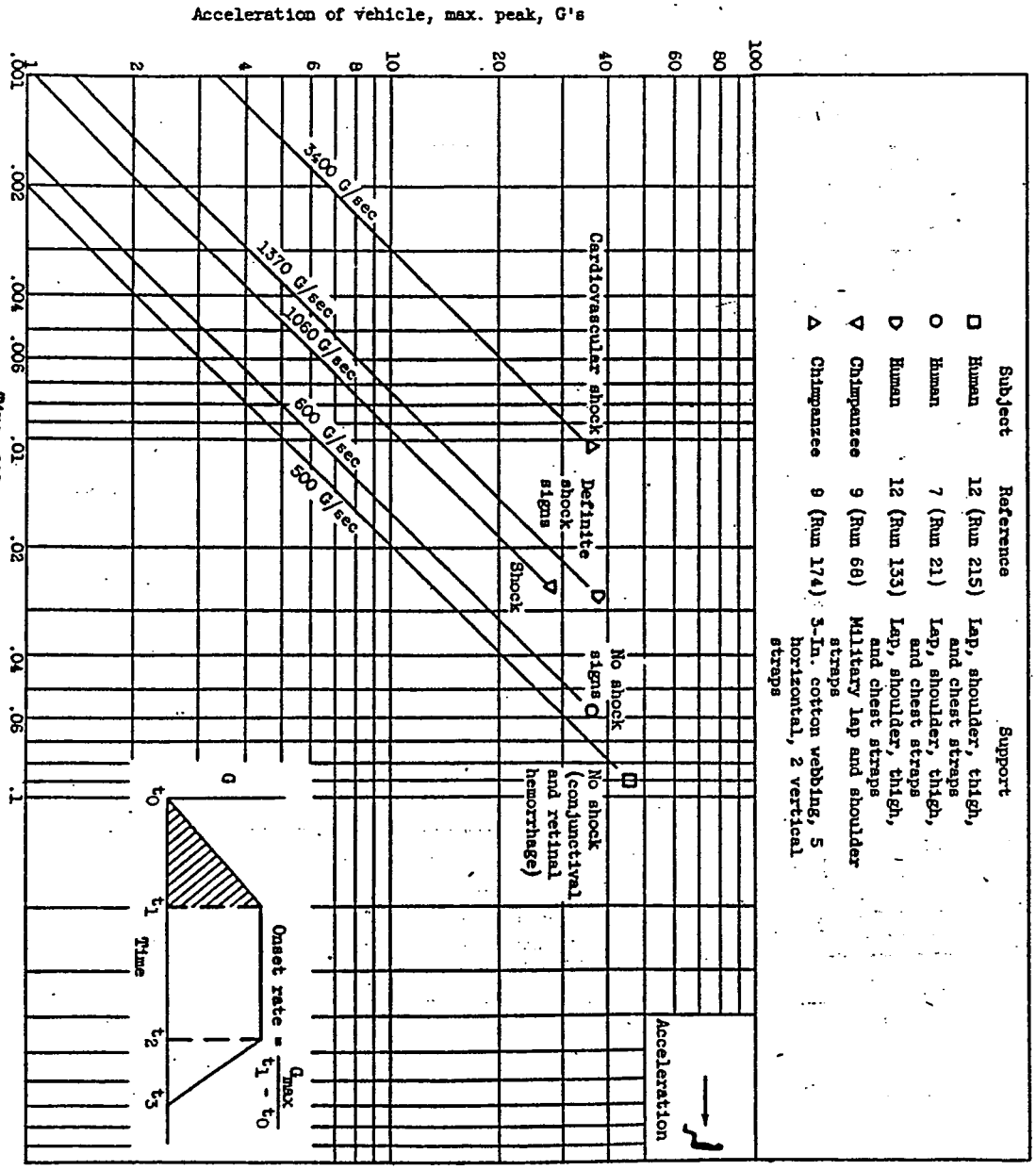

Figure 7. - Initial rate of change of spineward acceleration endured by various subjects.

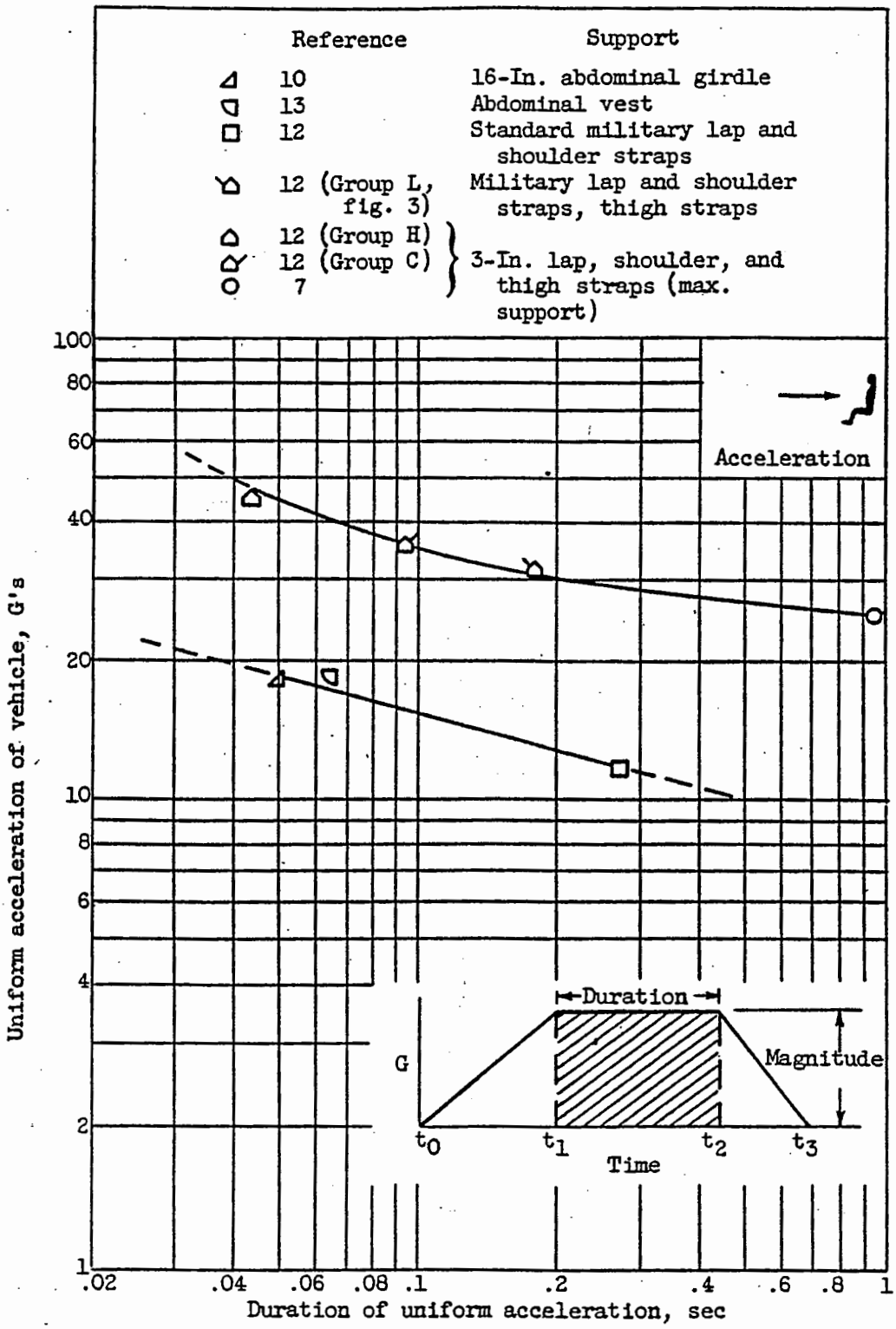

Figure 8. - Variation of voluntary human tolerance to spineward acceleration with method of total body support.

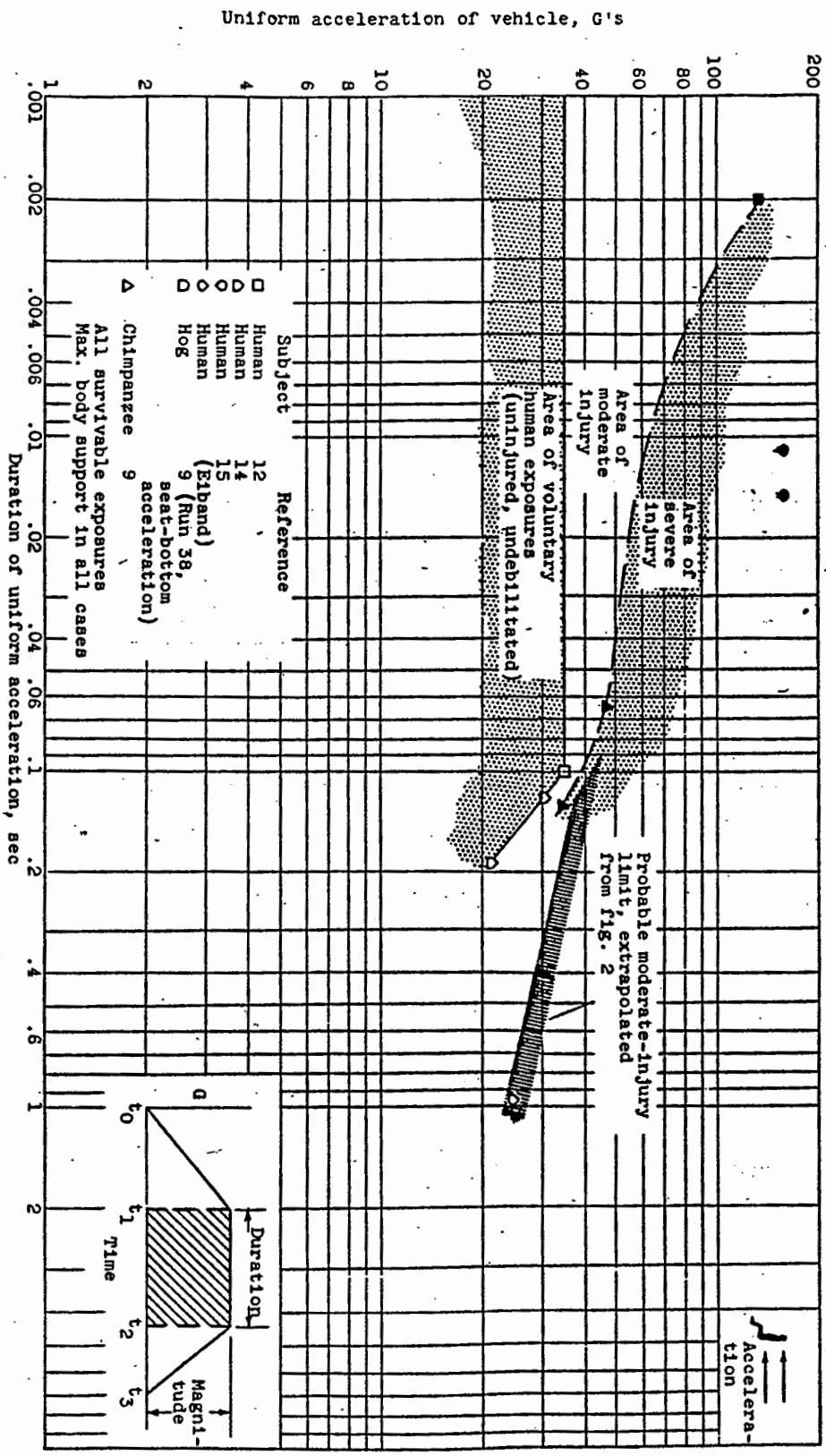

Figure 9. - Duration and magnitude of sternumward acceleration endured by various subjects.

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CB-9 back

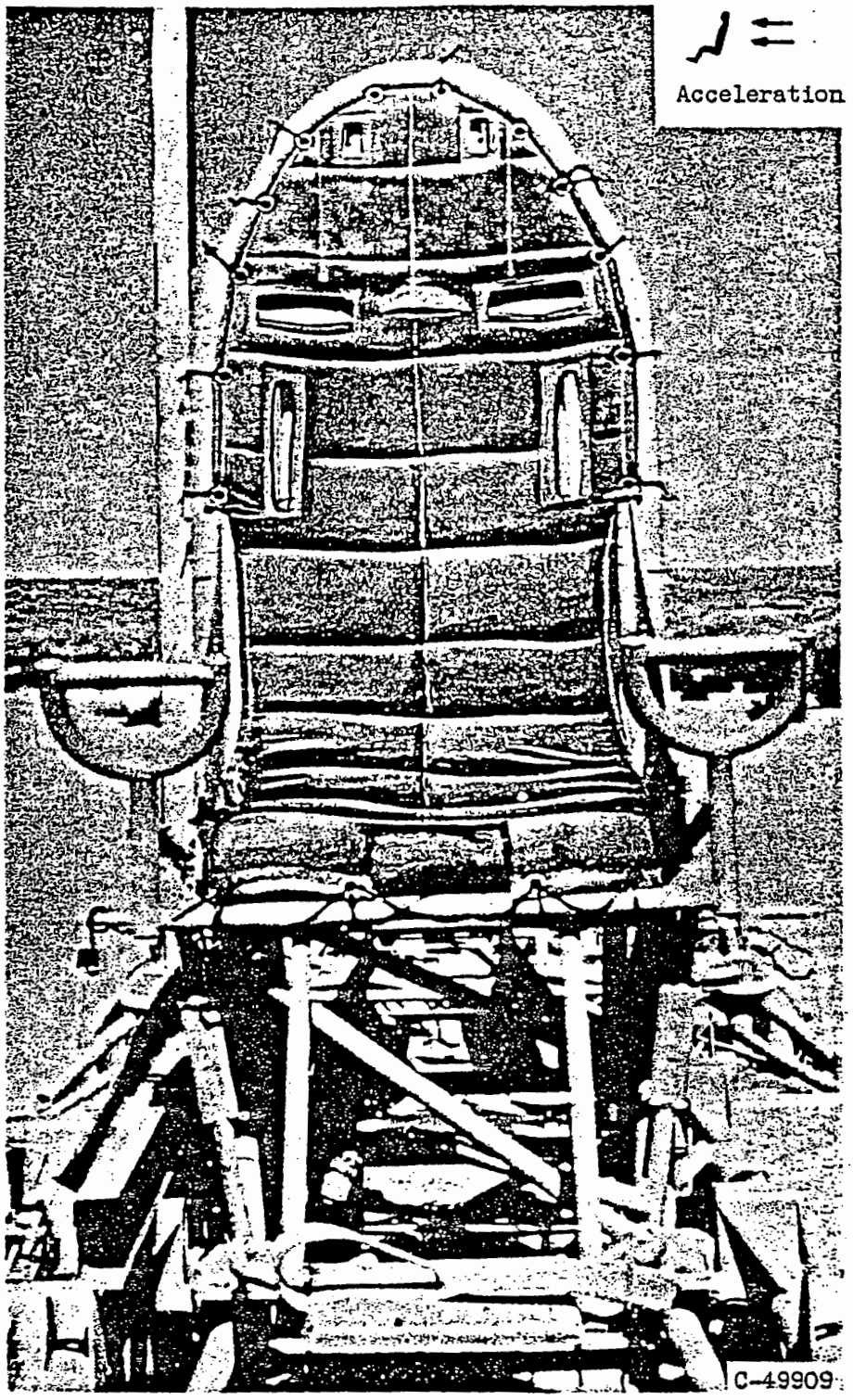

Figure 10. - Seat showing $\frac{1}{2}$-inch felt padding used as seat-back cushion in aft-faced experiments.

Figure 11. - 150-G, 56-pound seat structure used in aft-faced seating experiments of reference 12.

Figure 12. - Illustration of head-restraint posture; head relative to shoulder for 35-G sternumward exposures (ref. 14).

Figure 13. - Restraint for 35-G sternumward exposures (ref. 14).

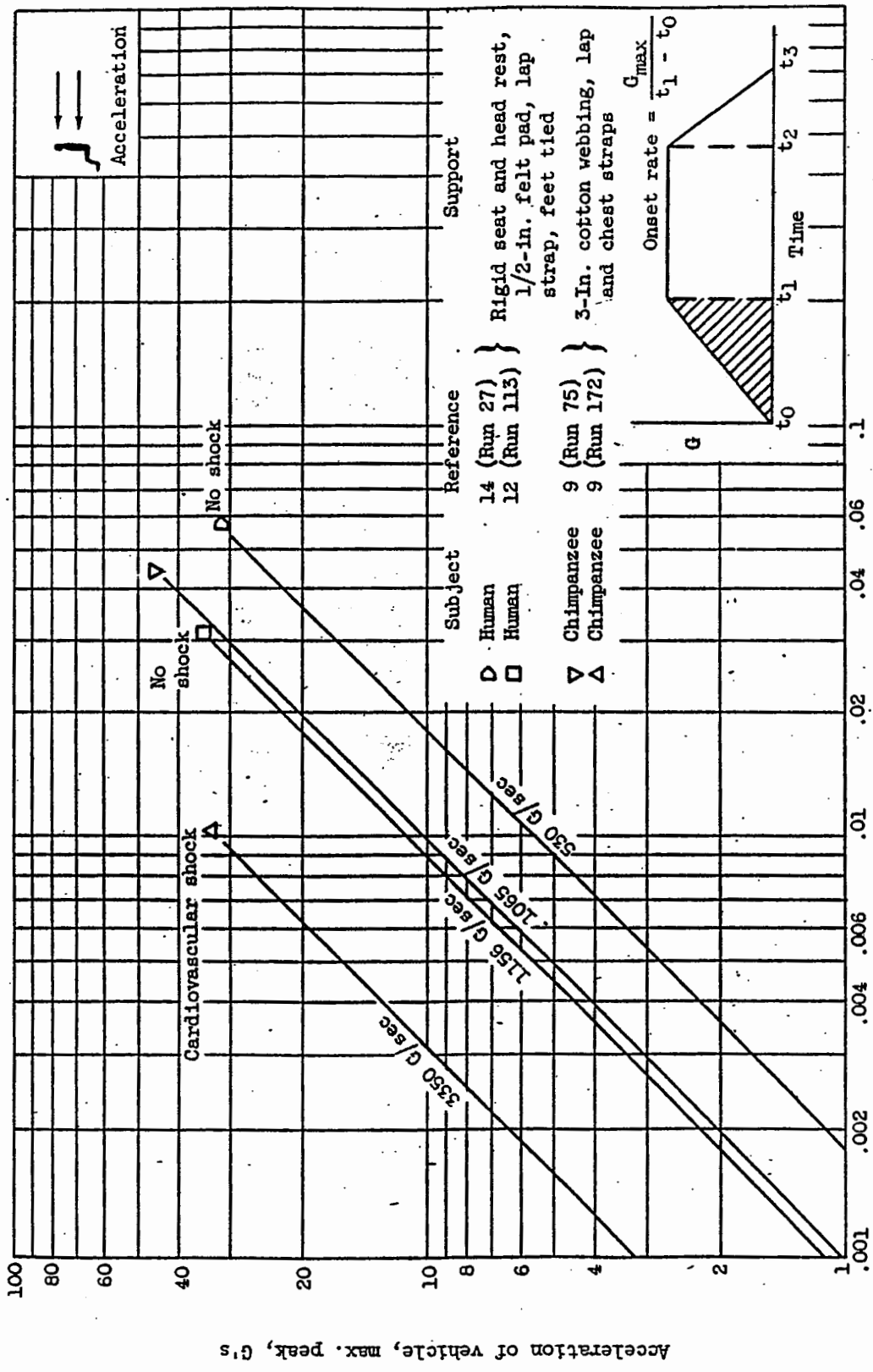

Figure 14. - Initial rate of change of sternumward acceleration endured by various subjects.

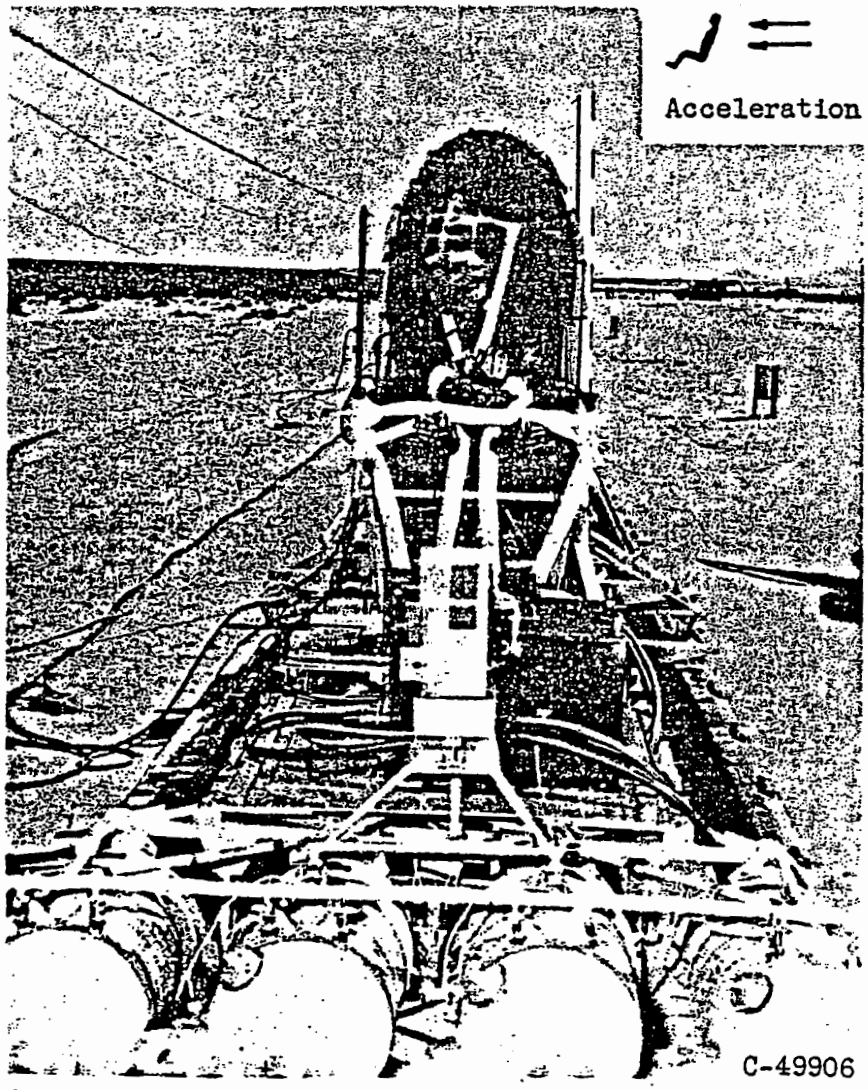

Figure 15. - Chimpanzee subject as restrained in aft-facing seat for exposure to sternumward acceleration (ref. 9).

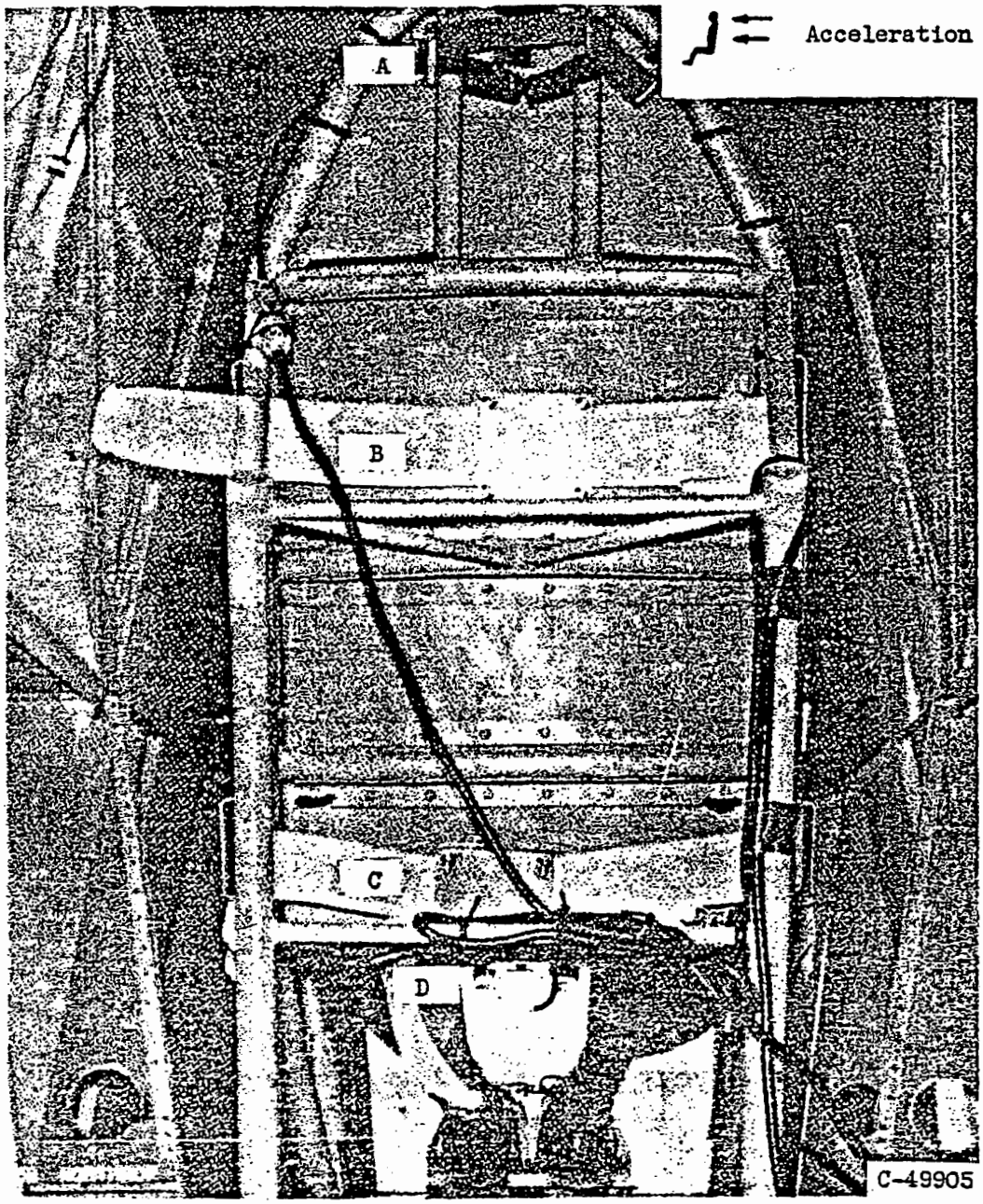

Figure 16. - Support for aft-facing seating experiments. Method of attaching (A) head straps, (B) chest strap, (C) lap strap, and for measuring (D) acceleration under seat (ref. 14).

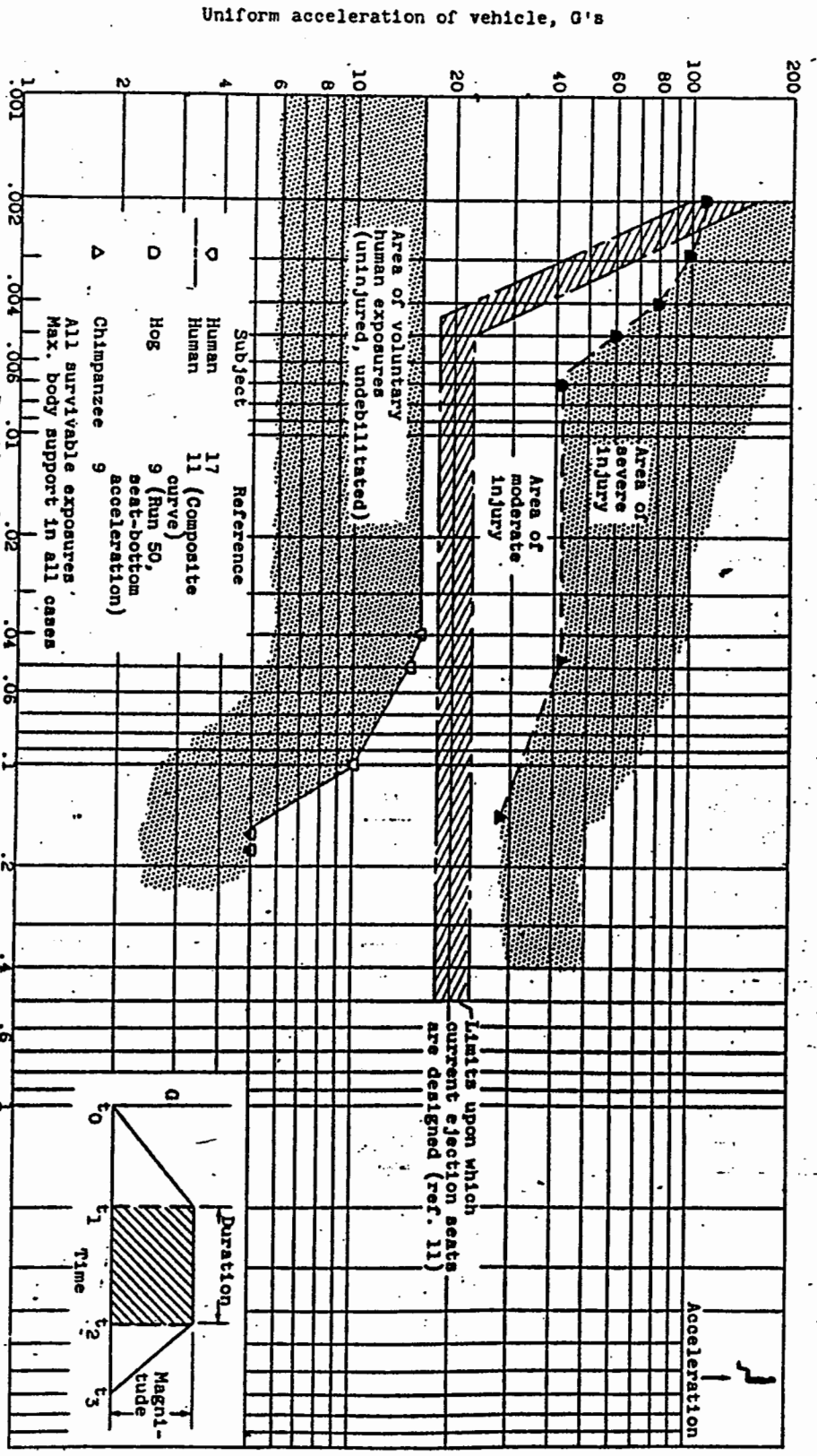

Figure 17. - Duration and magnitude of headward acceleration endured by various subjects.

Figure 18. - Desirable vertebral column alinement illustrated with face curtain drawn, prior to imposition of headward acceleration. Lap and shoulder straps restrain torso (ref. 26).

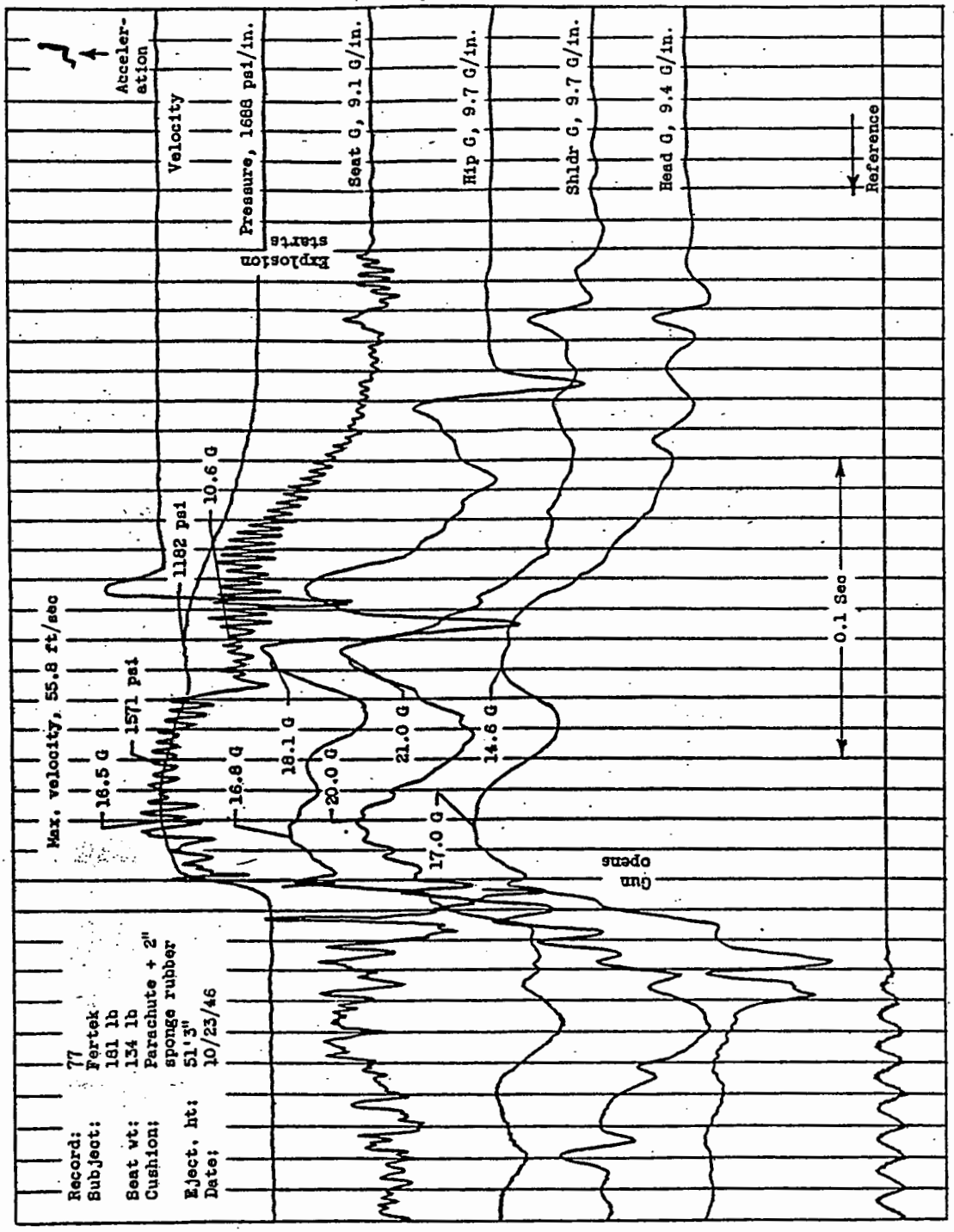

Figure 19. - Acceleration record from reference 17. Two 600-grain charges.

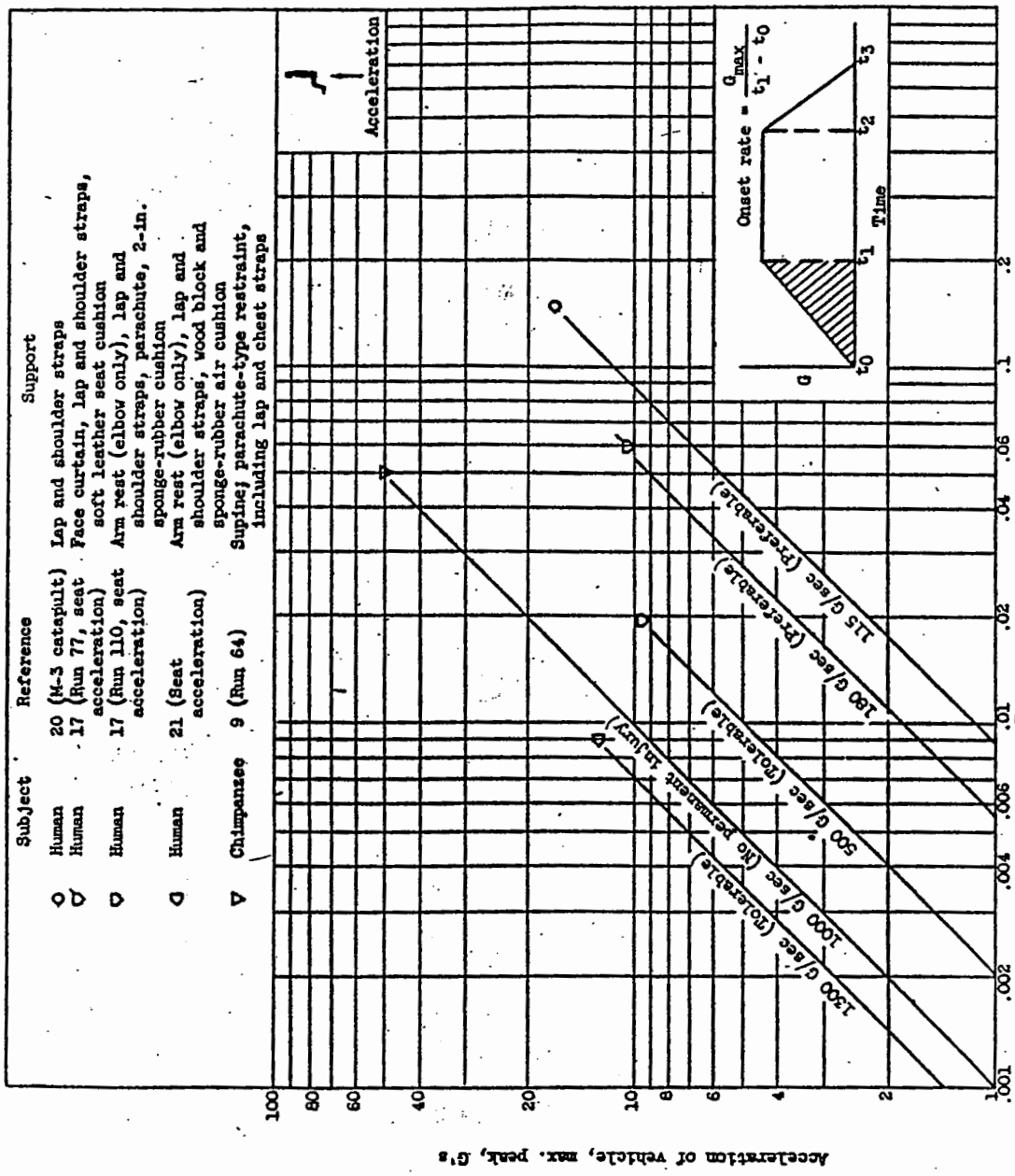

Figure 20. - Initial rate of change of headward acceleration endured by various subjects.

Figure 21. - Example of wedge-shaped fracture resulting from flexion of vertebral column during headward acceleration (ref. 25).

Figure 22. - Arm rests designed to relieve part of load on spine shown prior to imposition of headward acceleration. Lap and shoulder straps restrain torso (ref. 26).

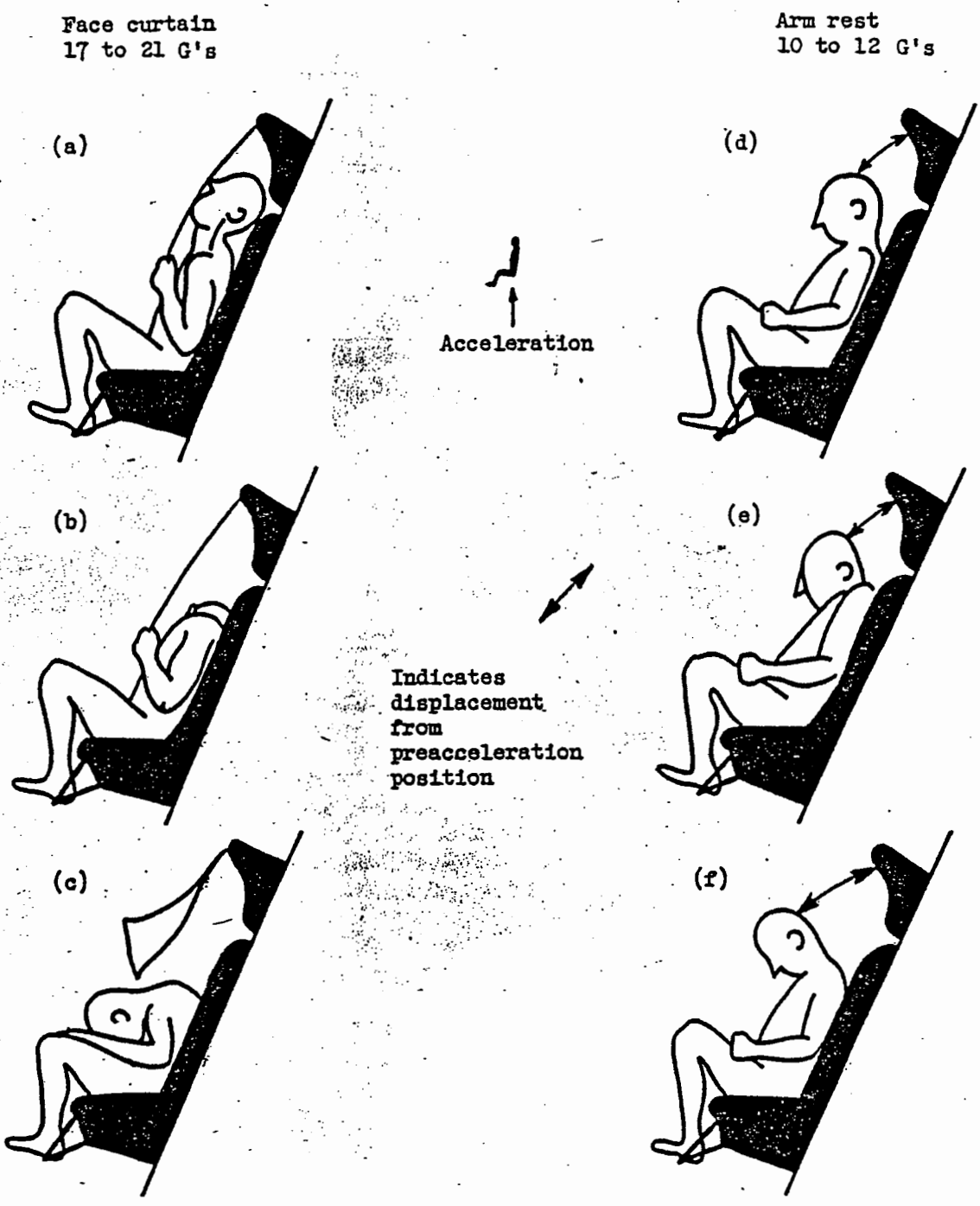

Figure 23. - Effect of head and neck alinement on tolerance to headward acceleration (revised from ref. 26).

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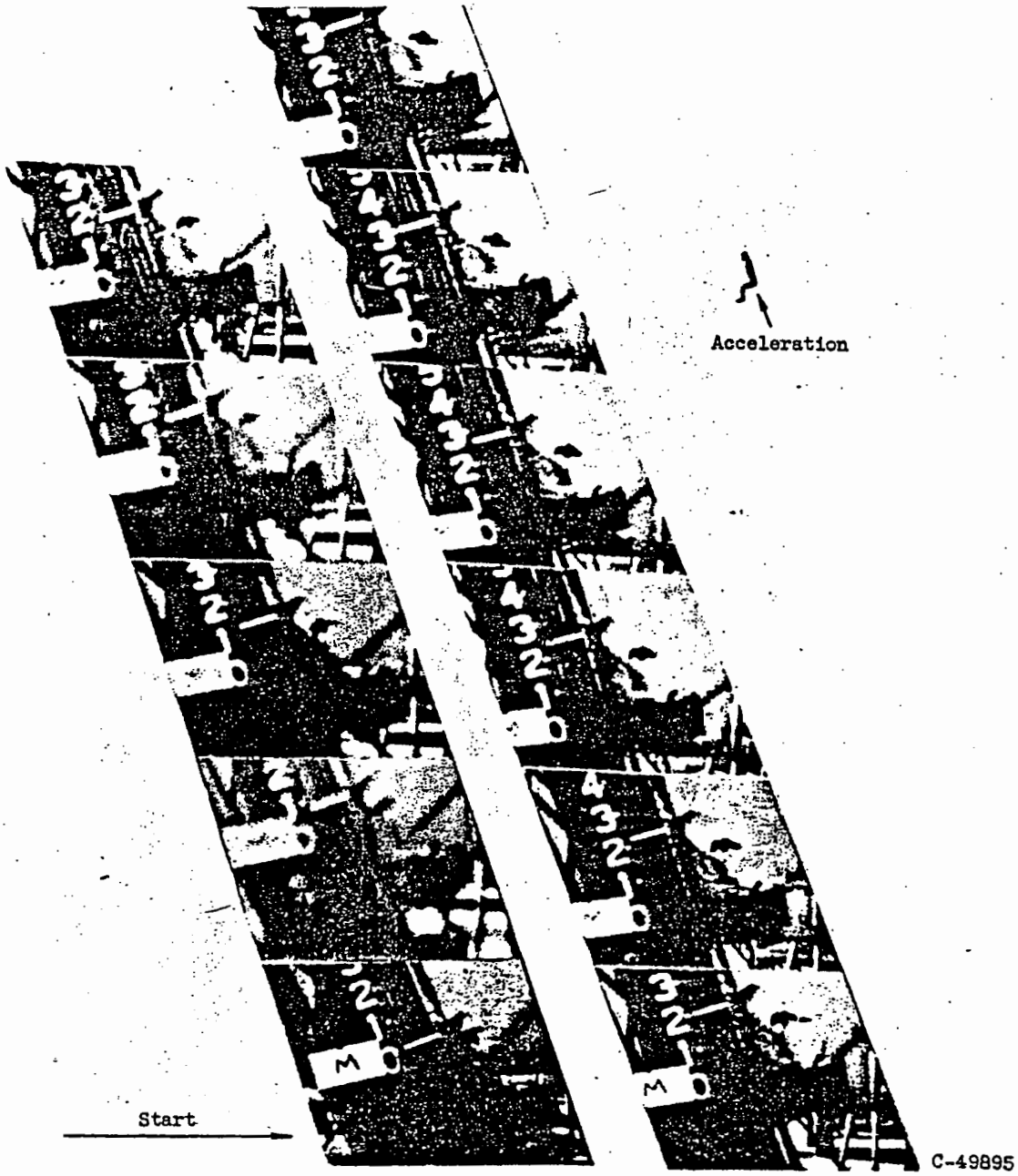


Figure 24. - Human subject unable to prevent undesirable neck flexion during imposition of headward acceleration. Lap and shoulder harness, arm rest restraint (ref. 26).

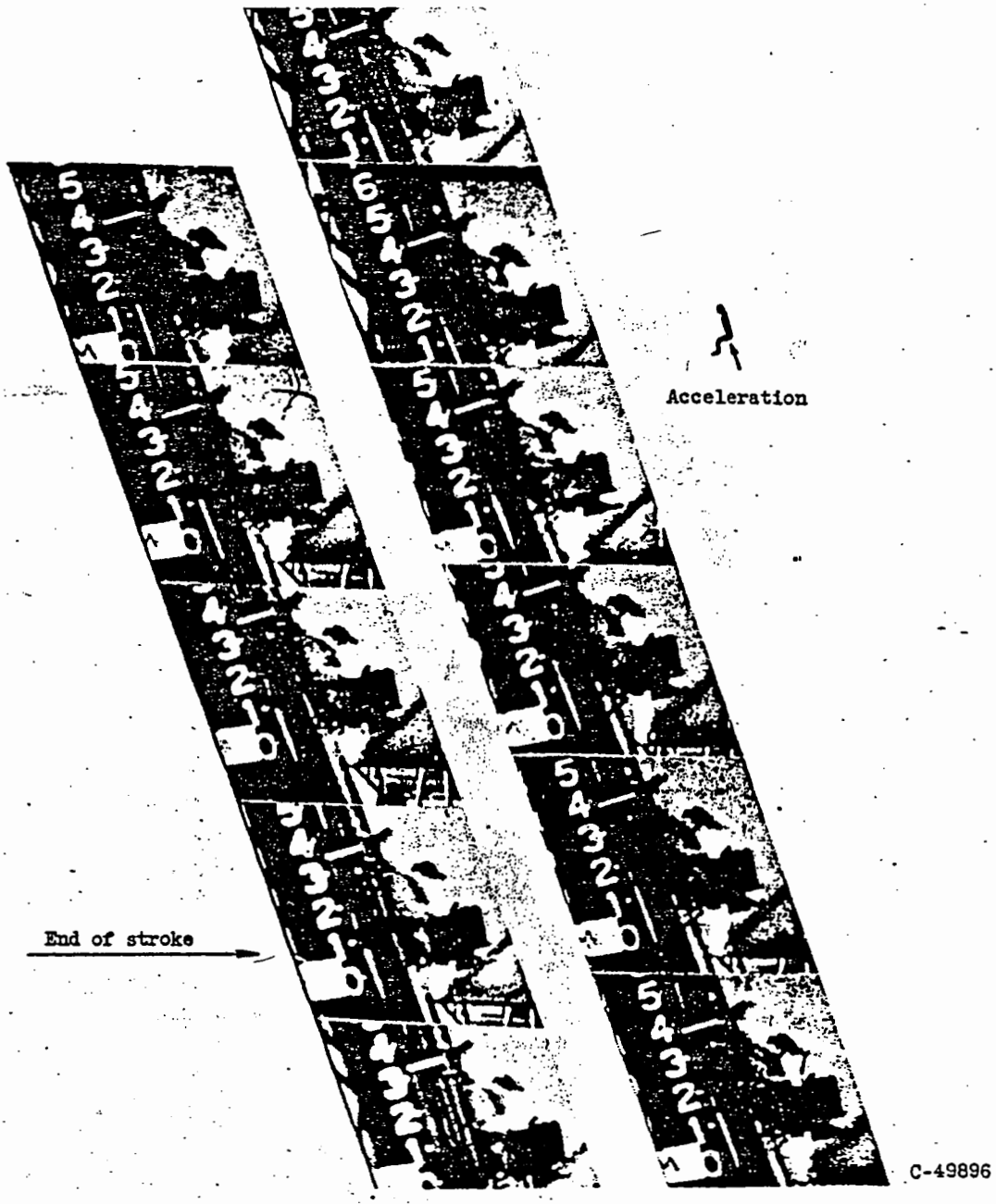


Figure 24. - Concluded. Human subject unable to prevent undesirable neck flexion during imposition of headward acceleration. Lap and shoulder harness, arm rest restraint (ref. 26).

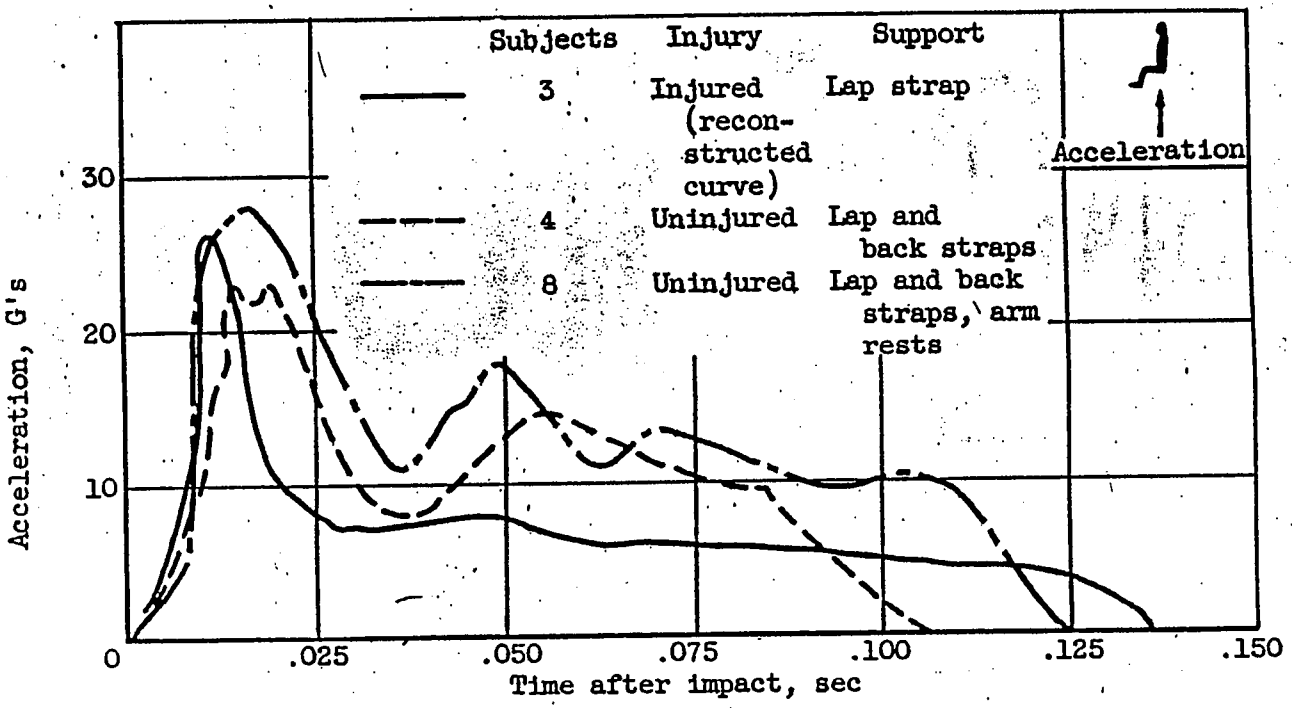


Figure 25. - Variation of voluntary human tolerance to headward acceleration with method of body support (ref. 11).

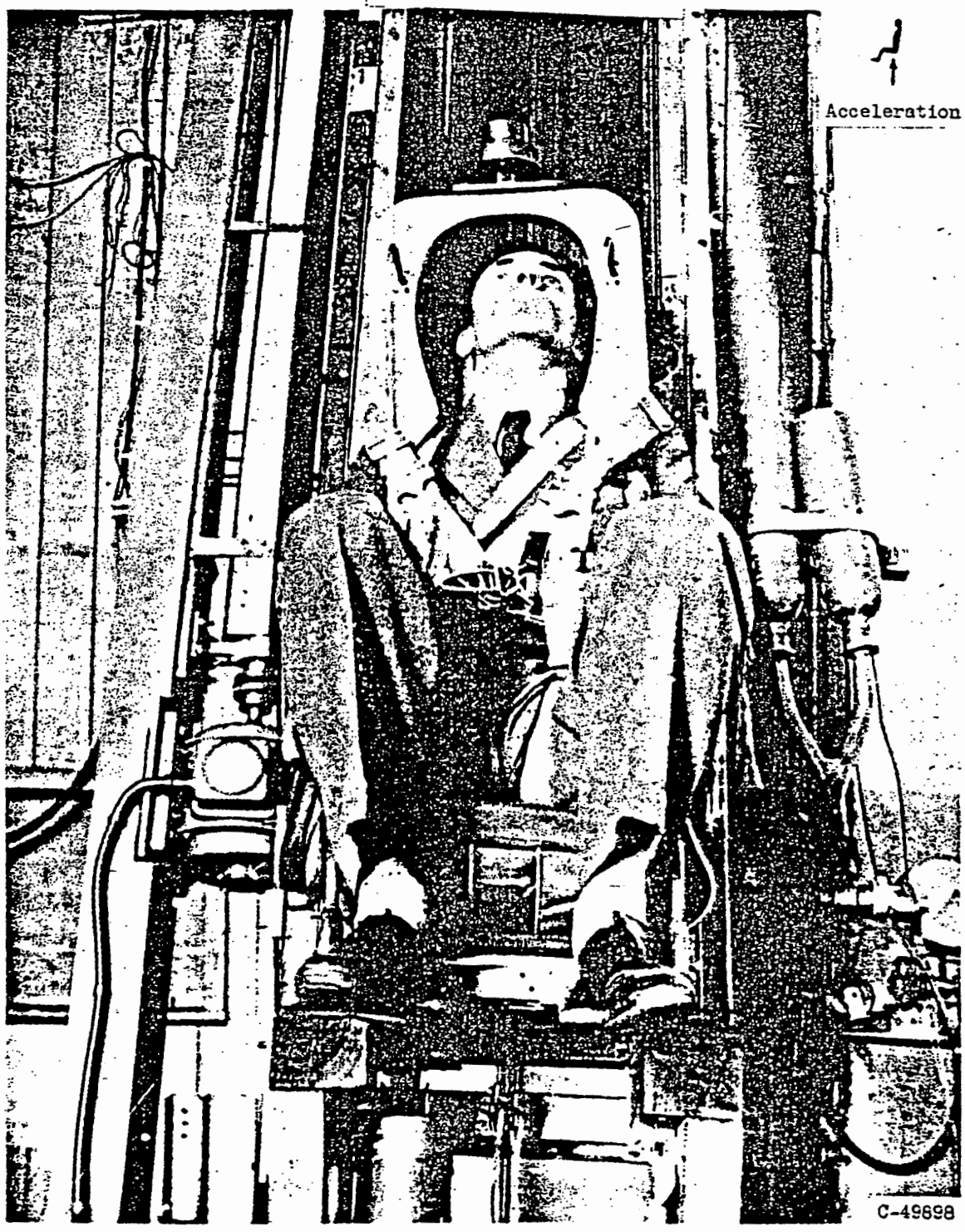


Figure 26. - Torso-restraining straps required to increase human tolerance in ejection experiments (headward acceleration, ref. 11).

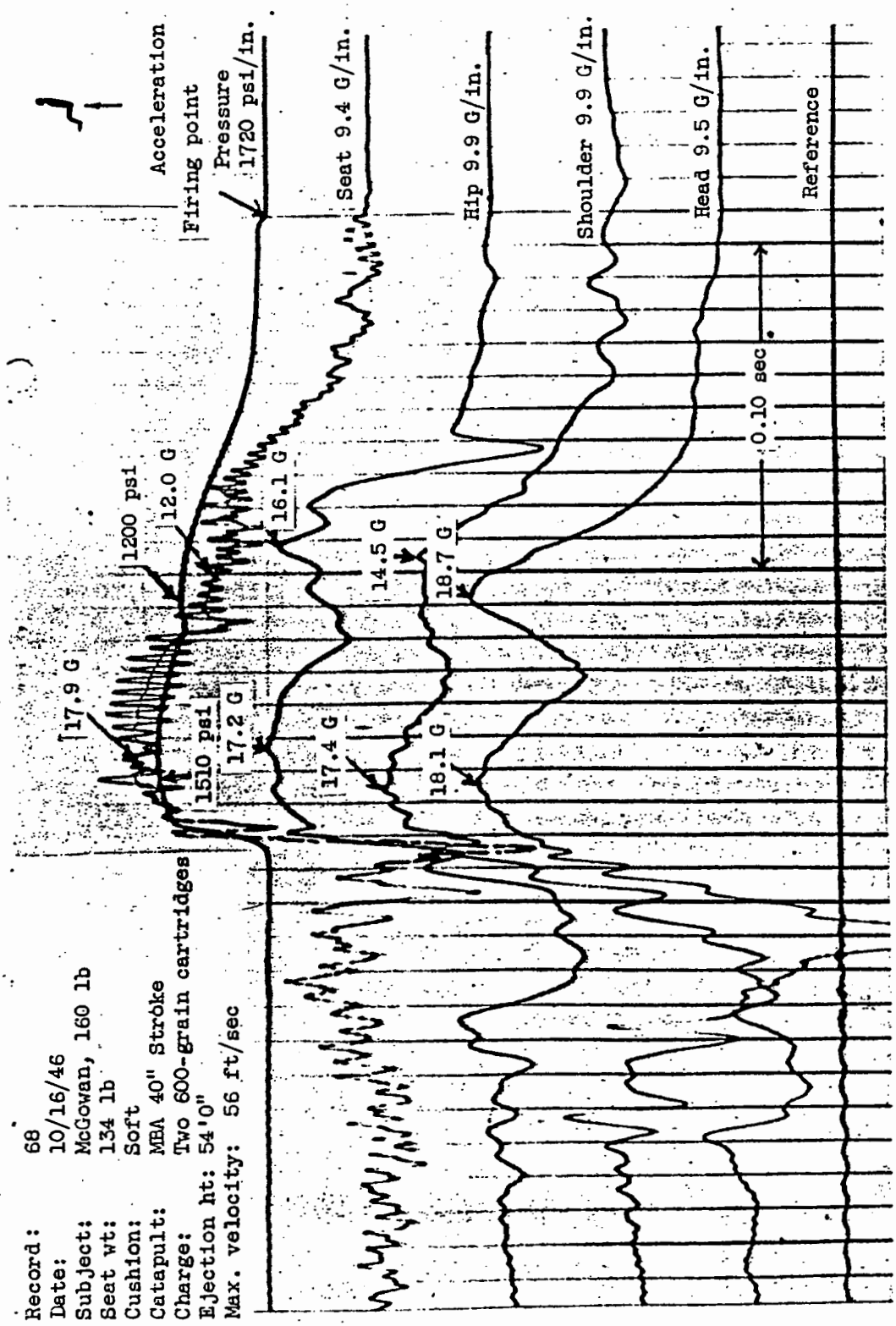


Figure 27. - Typical oscillograph record showing accelerations during experiment using face curtain (ref. 26).

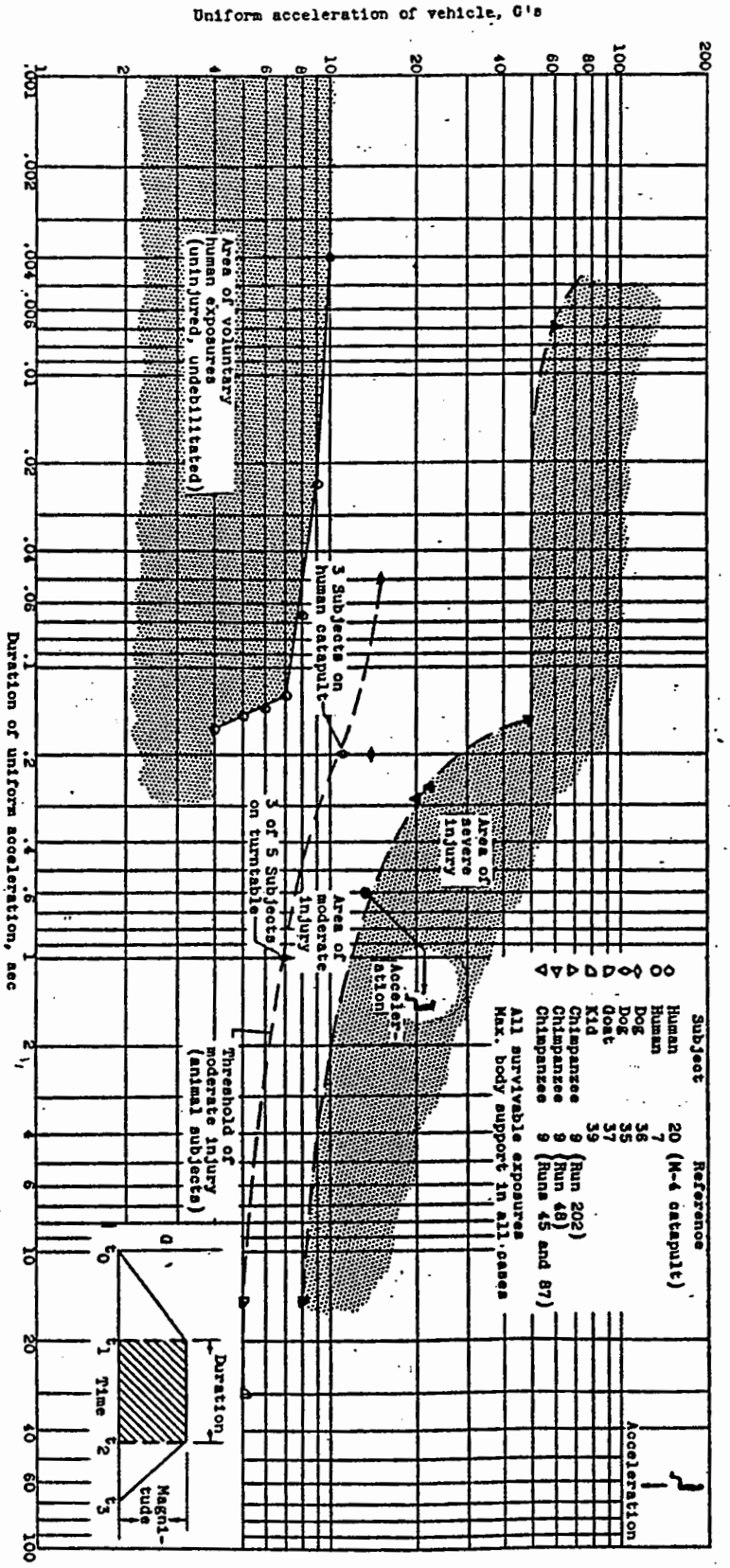


Figure 28. - Duration and magnitude of tailward acceleration endured by various subjects.

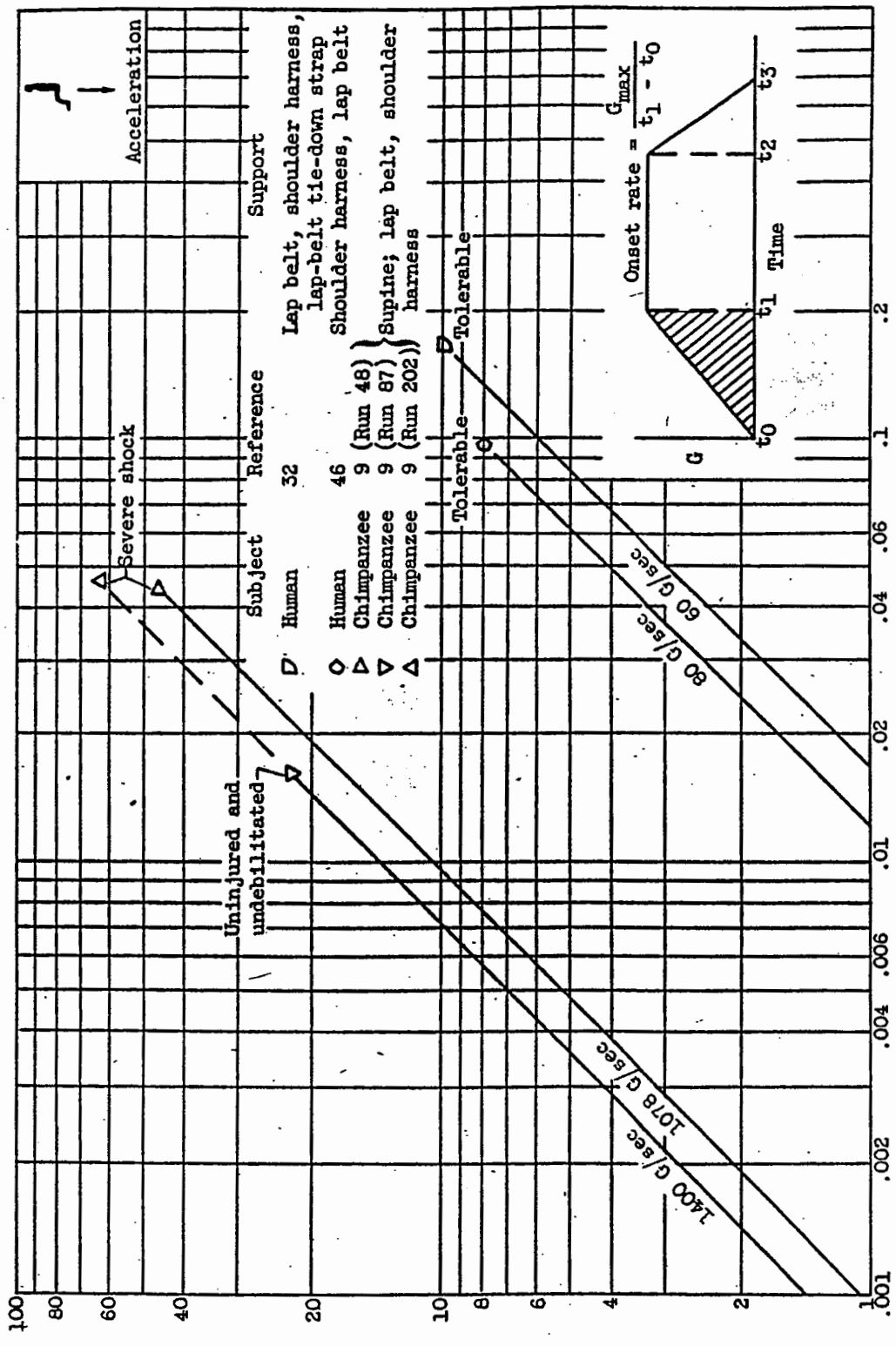
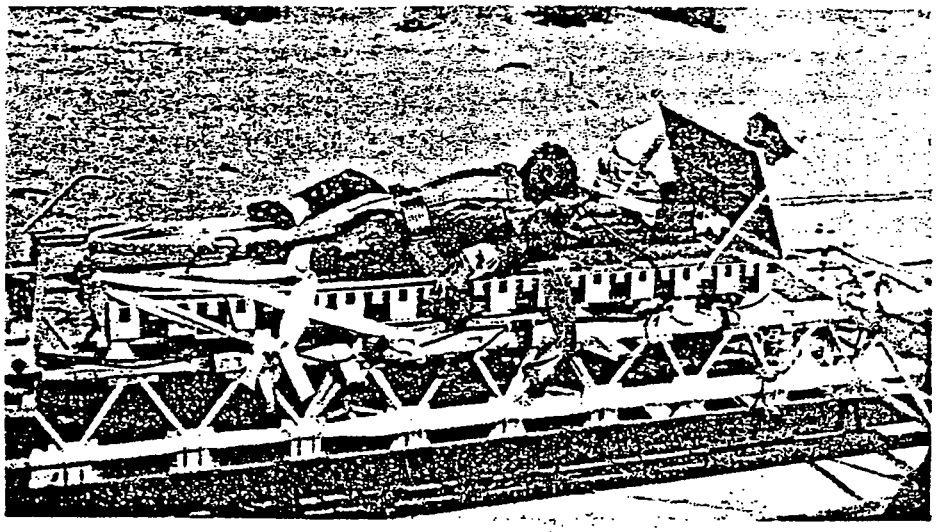
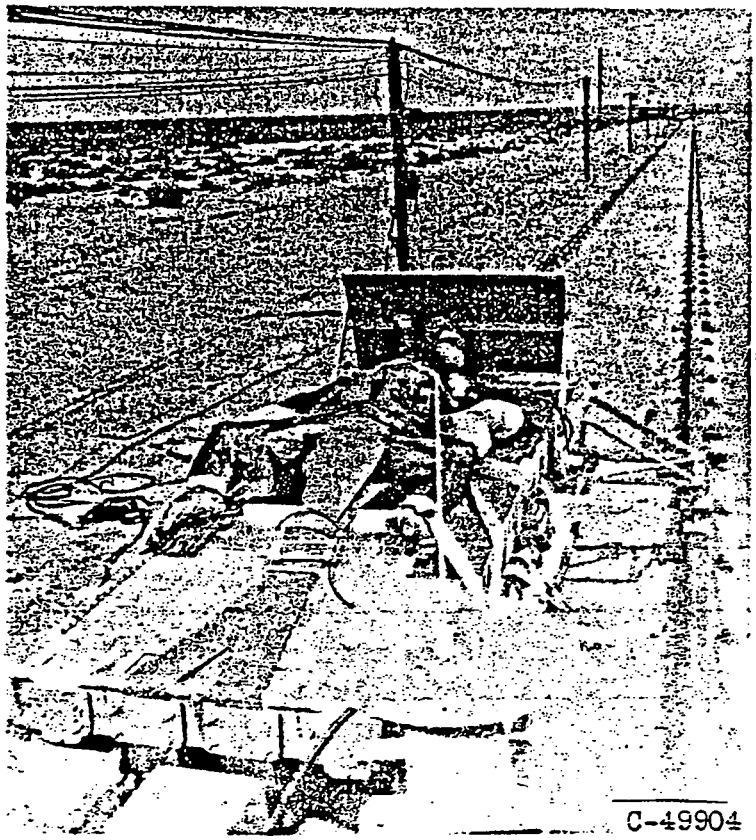


Figure 29. - Initial rate of change of tailward acceleration endured by various subjects.



Acceleration



C-49904

Figure 30. - Chimpanzee subject in restraining harness for exposure to tailward acceleration (ref. 9).

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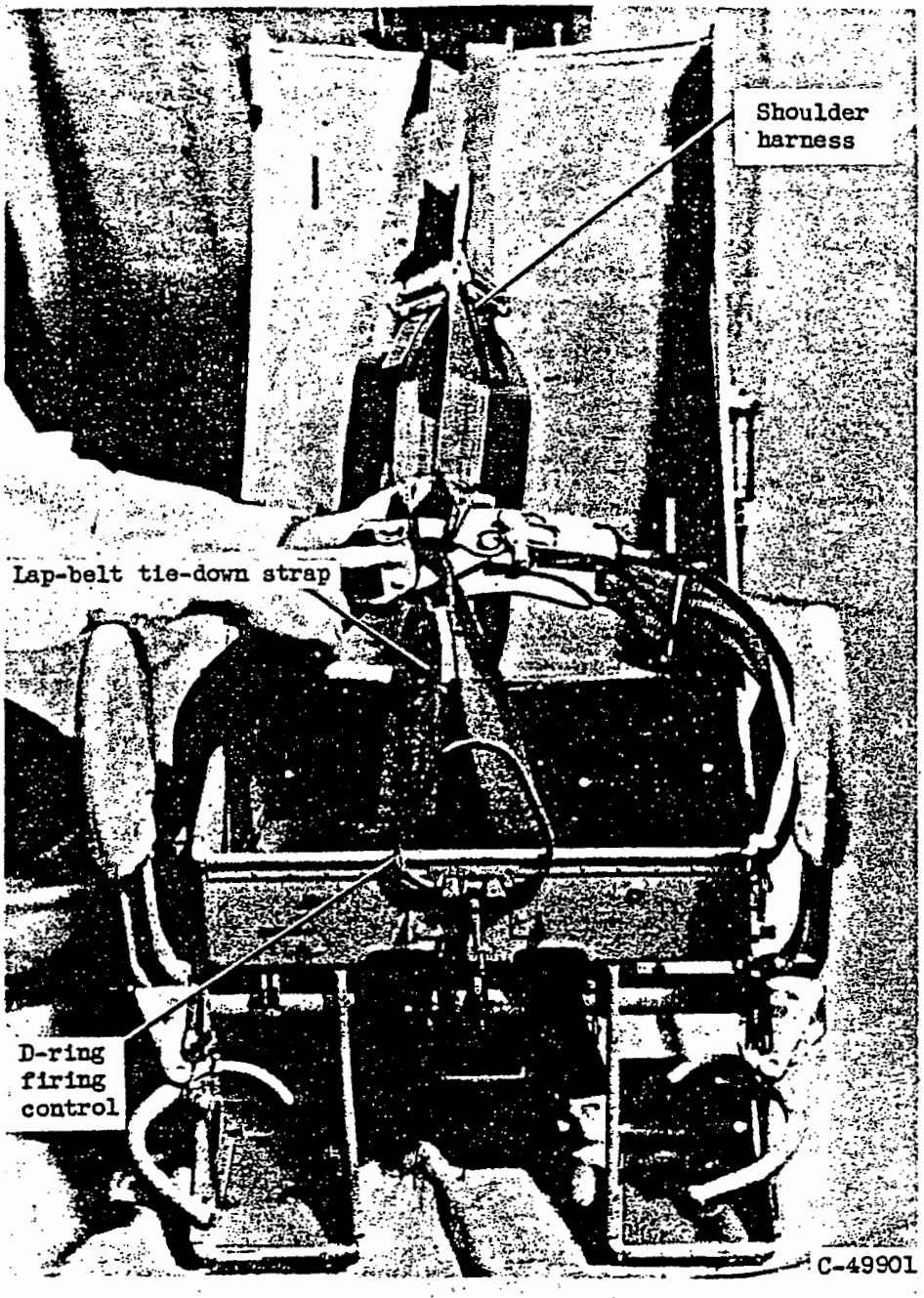
Direction of motion

Acceleration

C-49900

Figure 31. - Occupant movement from seat pan 6 inches during tailward acceleration with conventional lap- and shoulder-strap restraint (ref. 32).



Acceleration

Figure 32. - Lap-belt tie-down strap installation with conventional lap and shoulder straps (ref. 32).

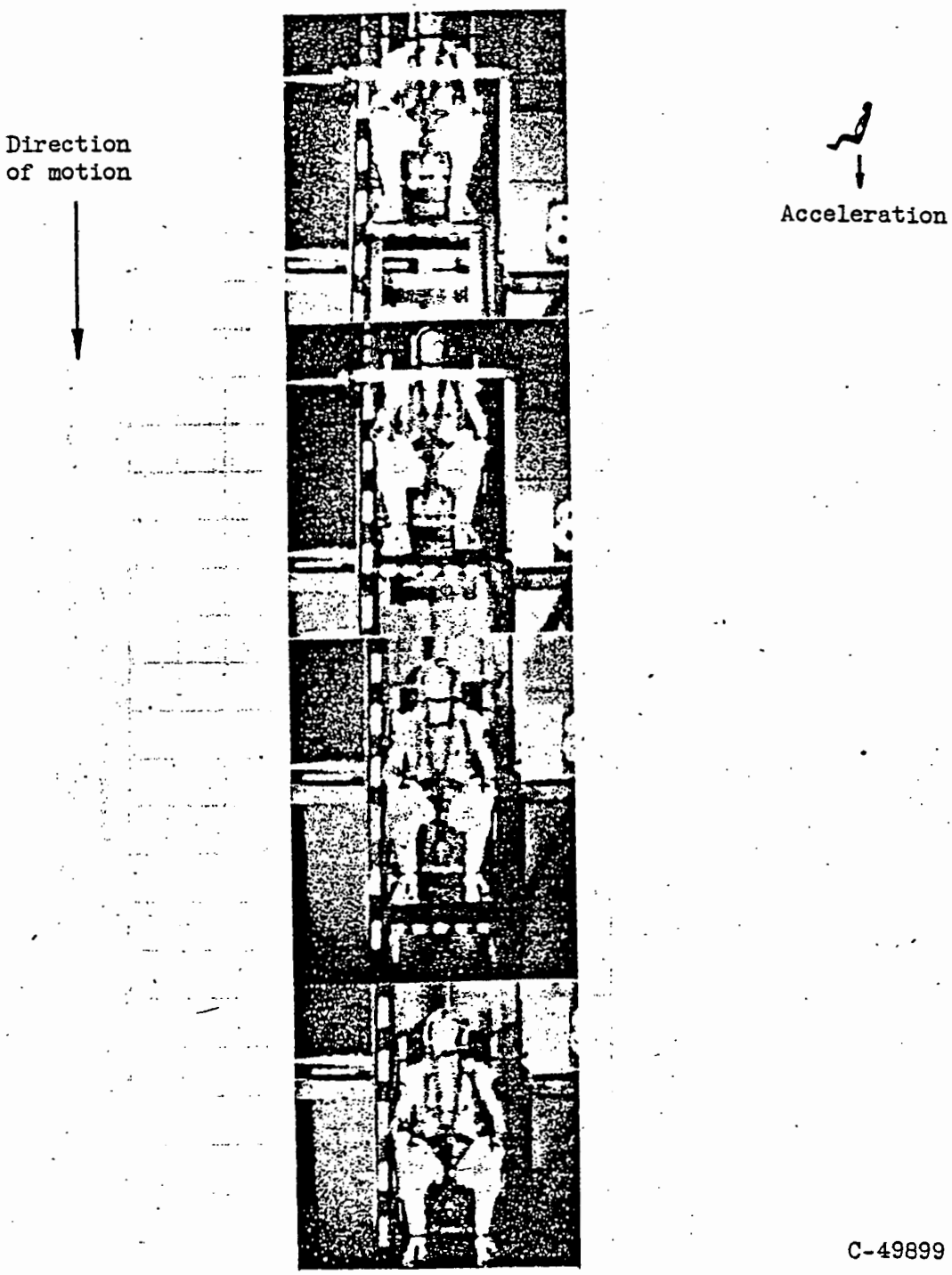


Figure 33. - Occupant movement from seat pan reduced to 3 inches during tailward acceleration when lap-belt tie-down strap added to conventional lap- and shoulder-strap restraint (ref. 32).

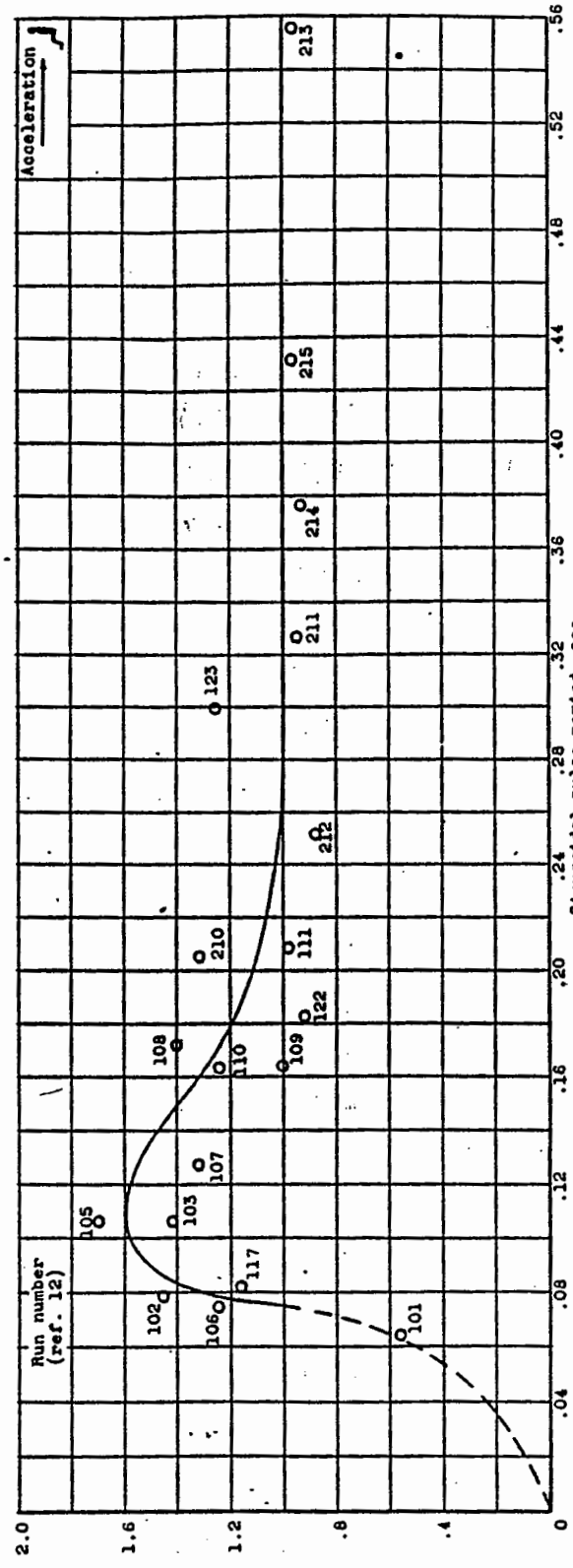


Figure 34. - Spineward acceleration of human subjects; frequency response as function of amplitude ratio. Period corrected to standard subject weight of 172 pounds (seat and subject = 232 lb).

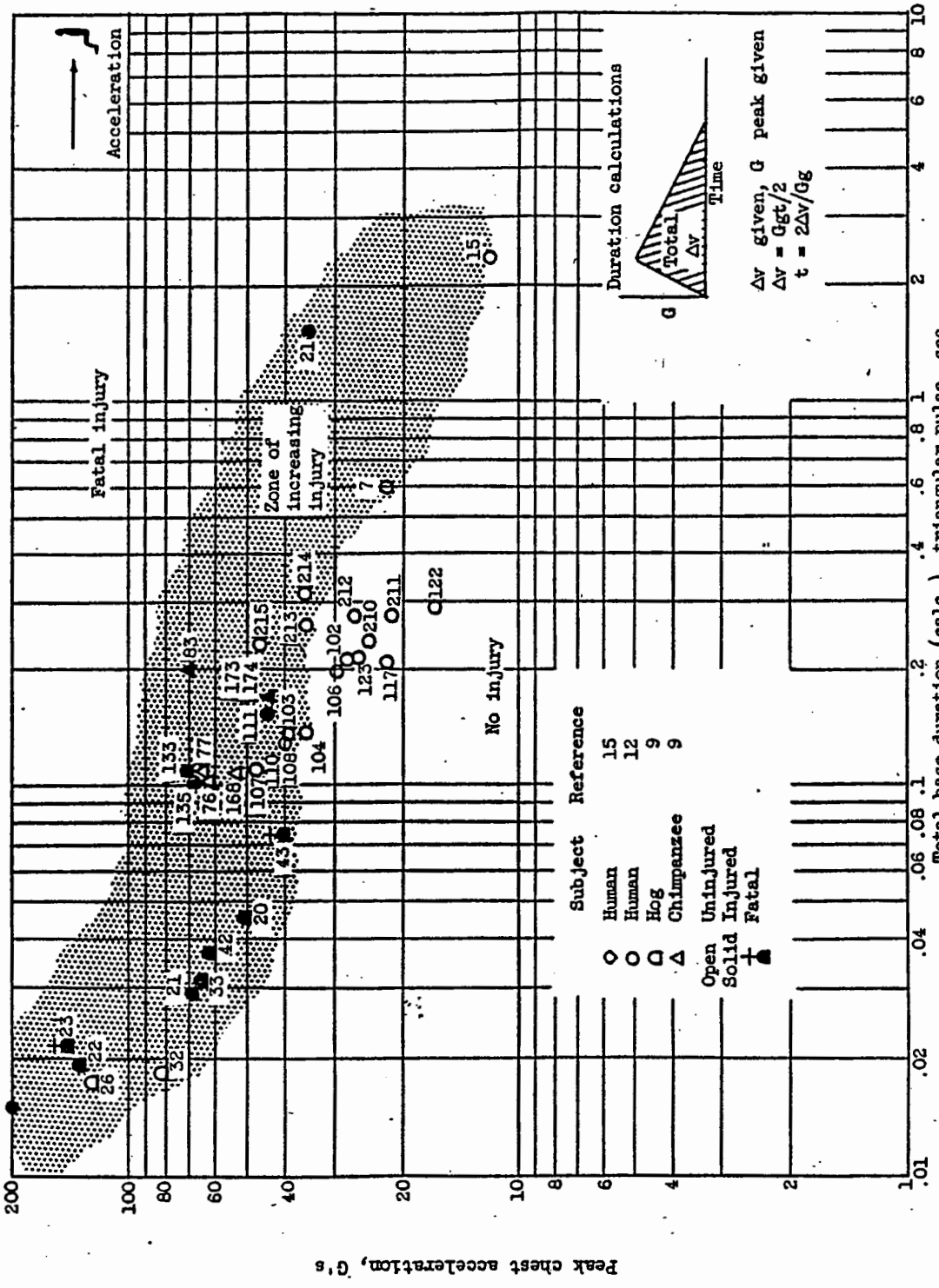


Figure 35. - Spineward-acceleration injury levels. (Numbers are run numbers.)

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HUMAN TOLERANCE TO RAPIDLY APPLIED ACCELERATIONS: A SUMMARY OF THE LITERATURE. A. Martin Eiband. June 1959. ii, 93p. diagrs., photos., tabs. (NASA MEMORANDUM 5-19-59E)

Data applicable to space flight and to crash impact forces were obtained from a literature survey and analyzed and discussed. These data are compared and presented on the basis of a trapezoidal pulse to show the effects of body restraint and of acceleration direction, onset rate, and plateau duration on the maximum tolerable magnitude of rapidly applied accelerations. Recommendations indicated by the survey are made for increasing impact survivability by use of adequate body support in both the forward- and aft-facing seated positions. A categorized bibliography of information on human tolerance to rapidly applied accelerations is included.

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